United States Patent

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[33] Germany
[31] P 19 09 447.4

[54] **FLYING CRAFT**
56 Claims, 14 Drawing Figs.

[52] U.S. Cl. 244/12 C, 244/23 C
[51] Int. Cl. B64c 29/00
[50] Field of Search 244/12, 135, 23; 416/142

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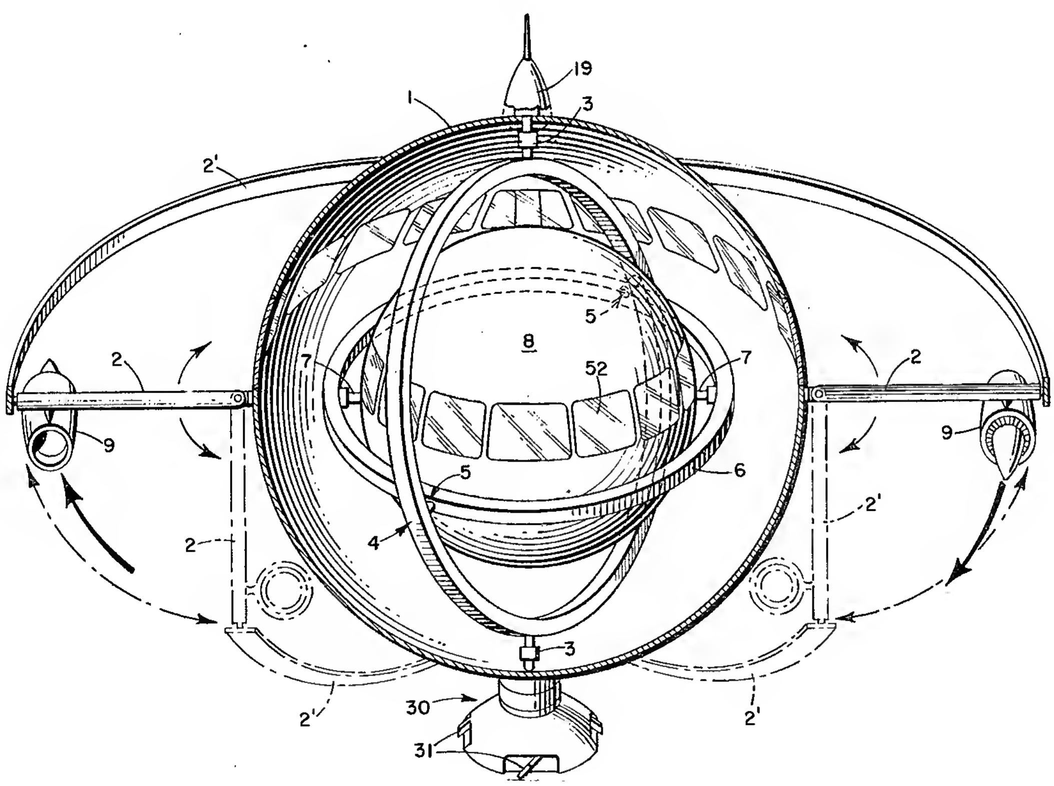
ABSTRACT: A flying craft comprised of a rotating outer body and a stationary cabin pivotally mounted therein about three axes which are in perpendicular succession to each other.



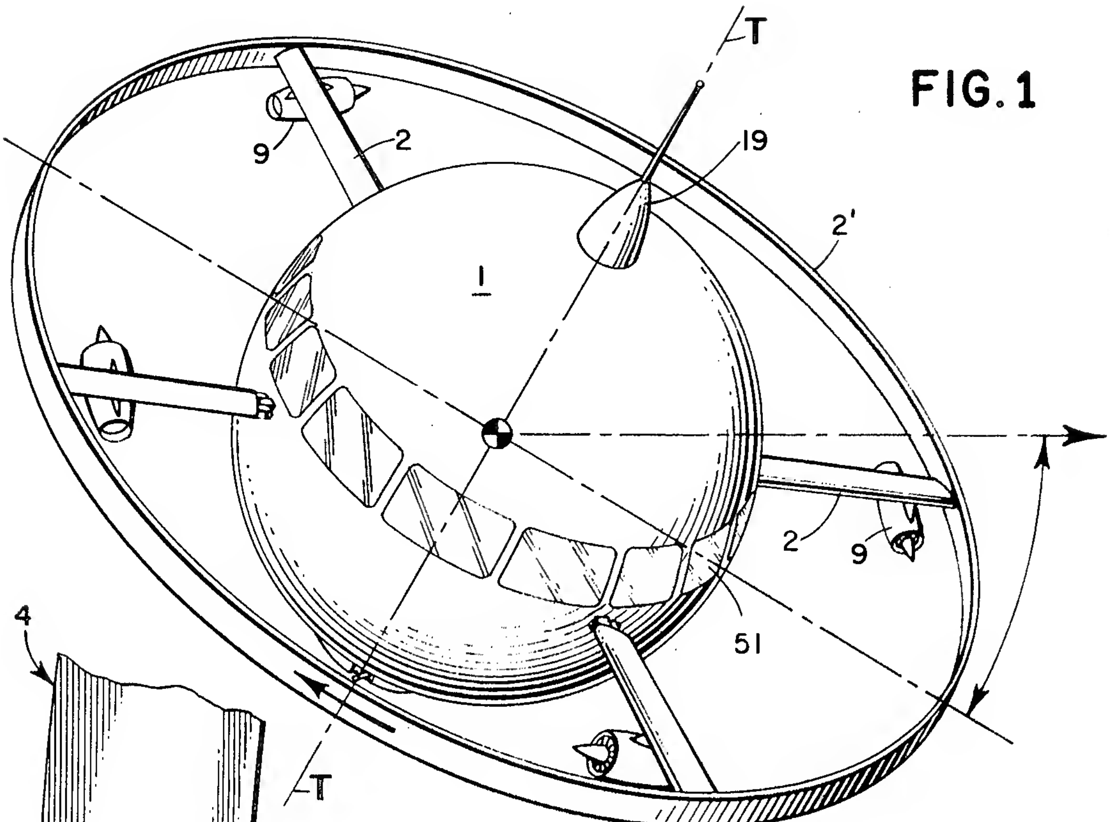


FIG. 1

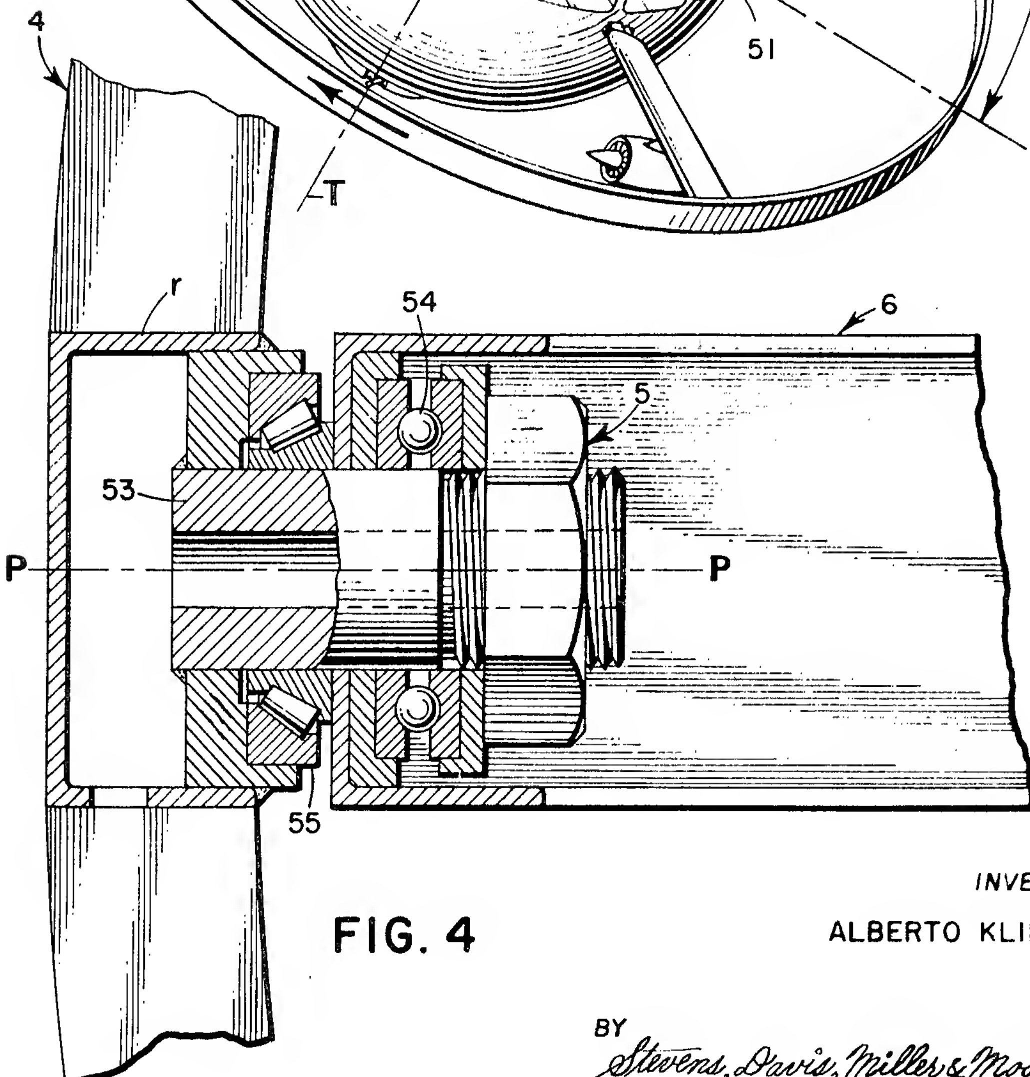


FIG. 4

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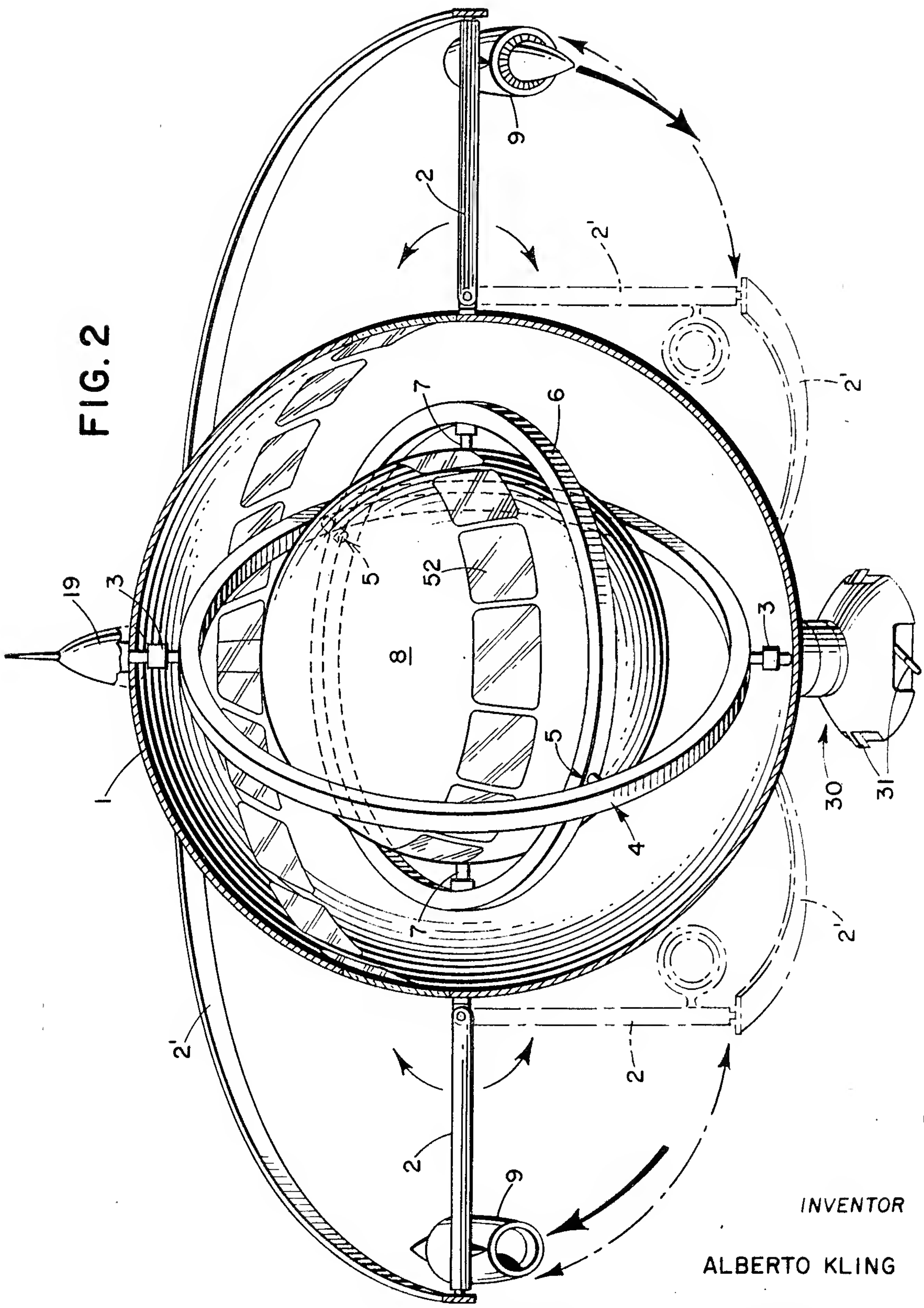

FIG. 2

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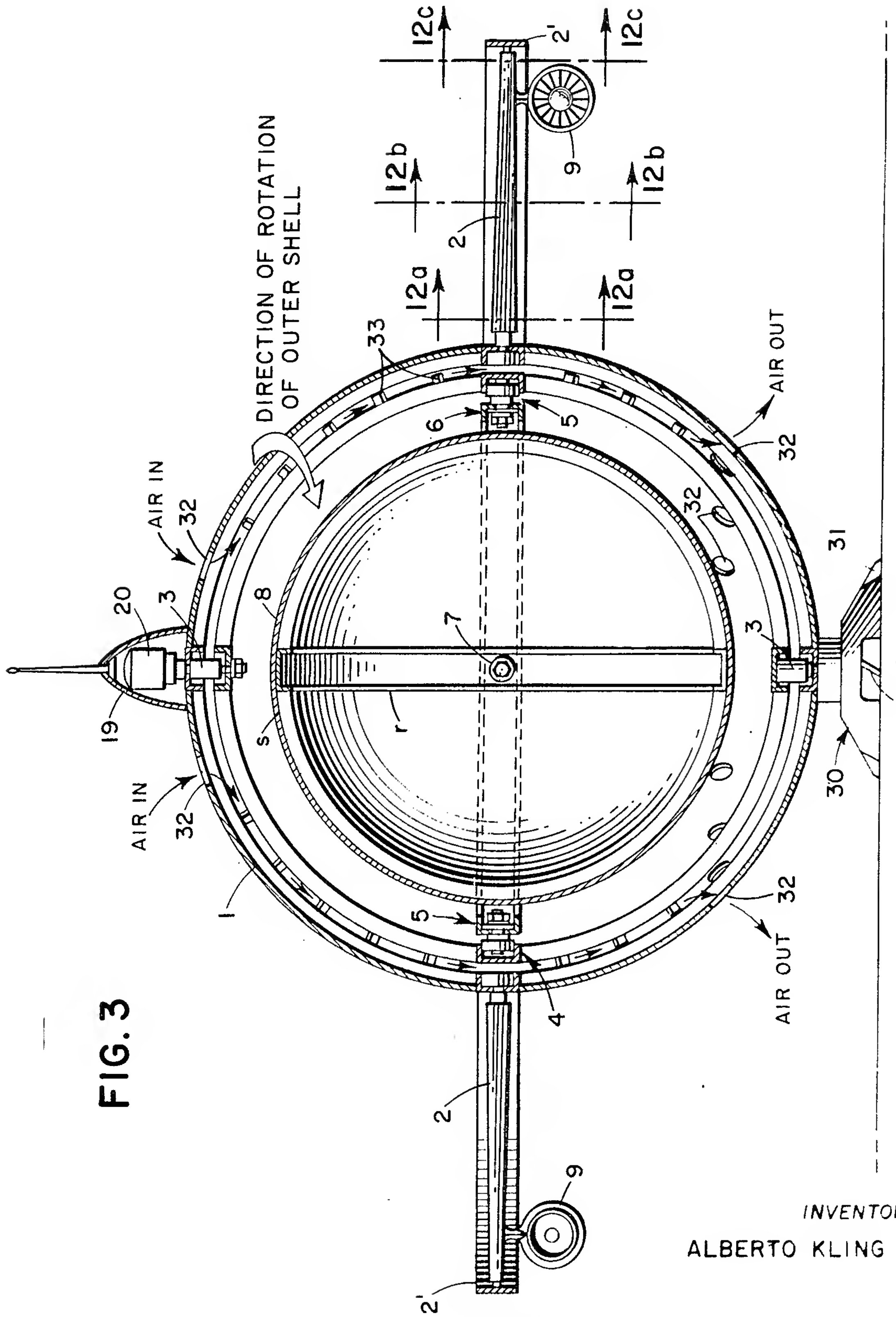

FIG. 3

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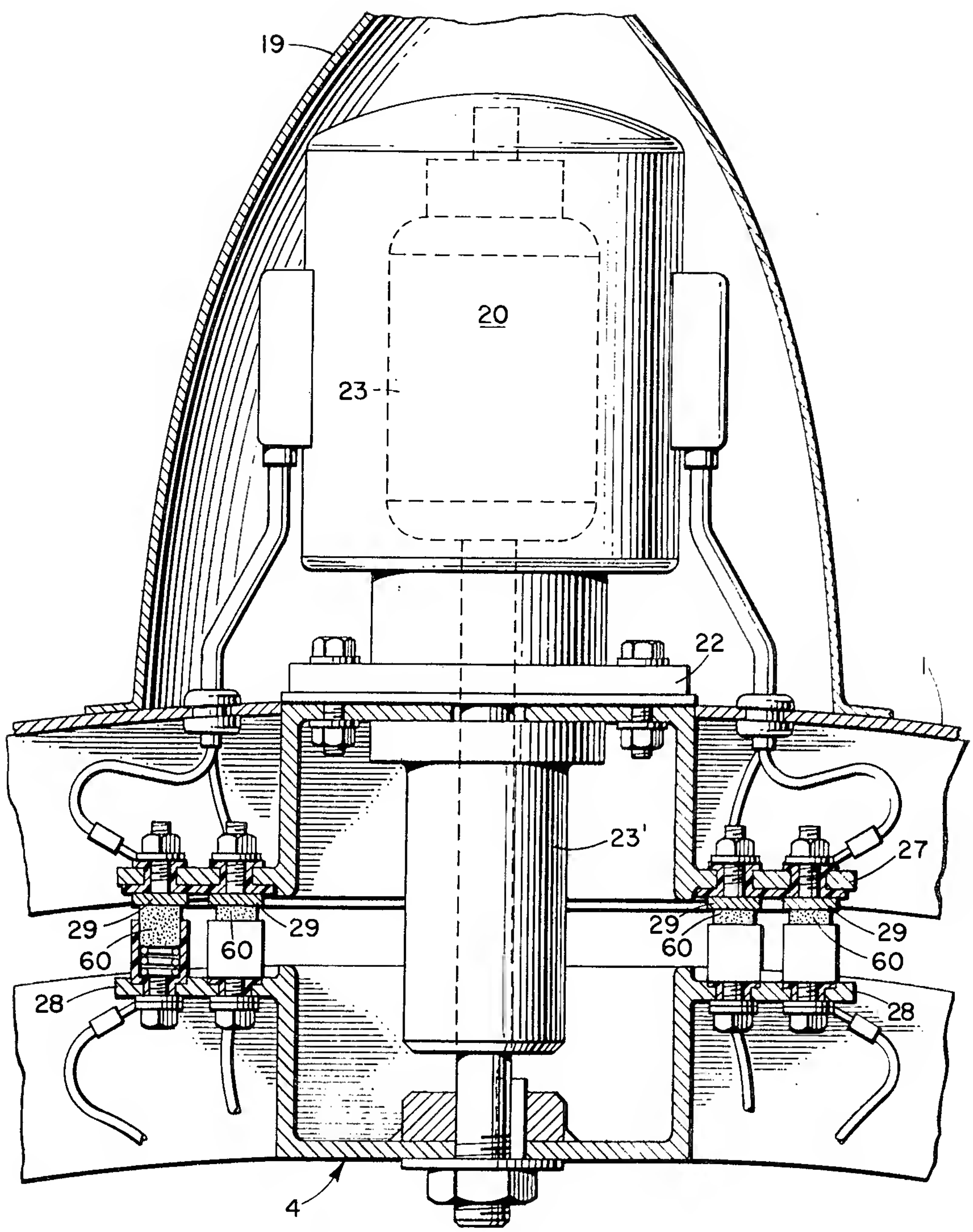

FIG. 5

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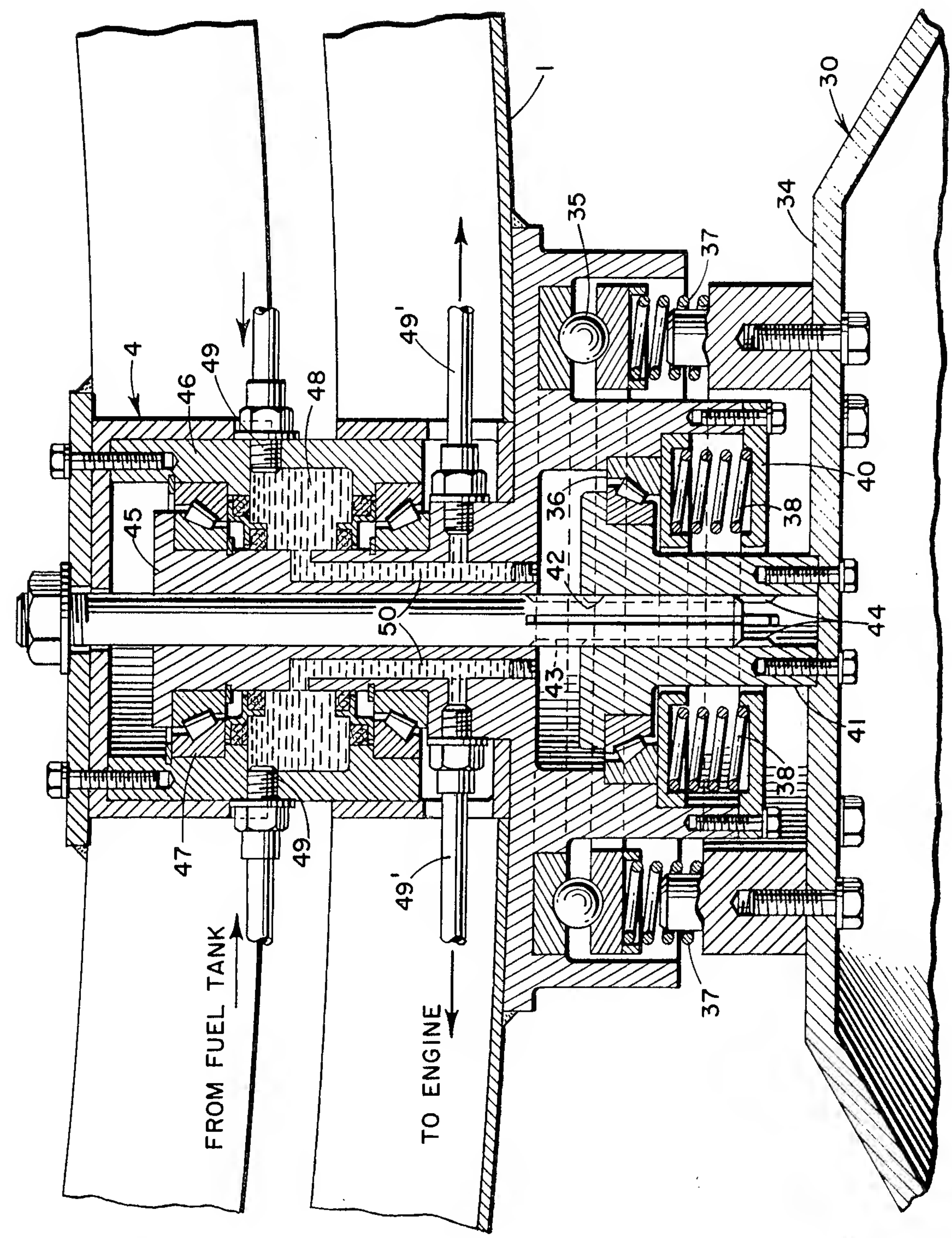

FIG. 6

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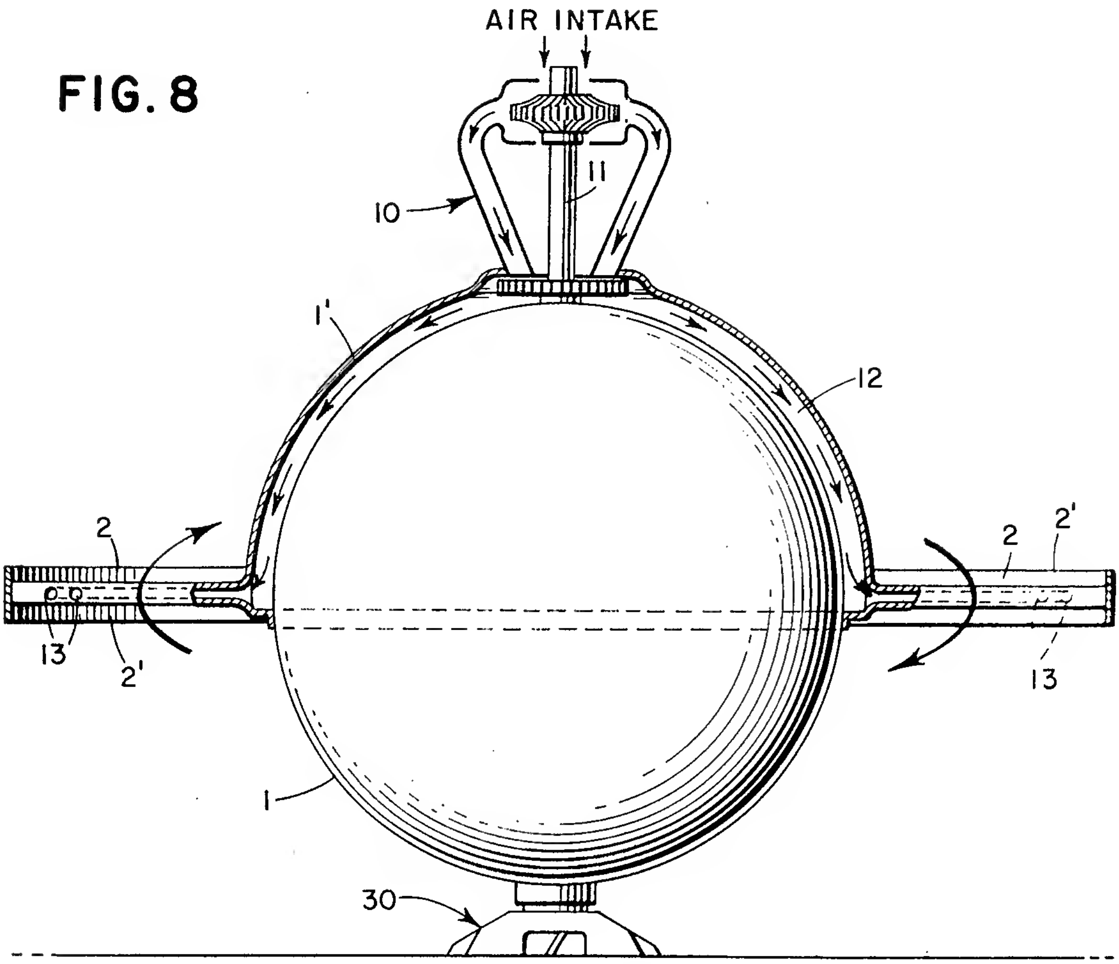
FIG. 8



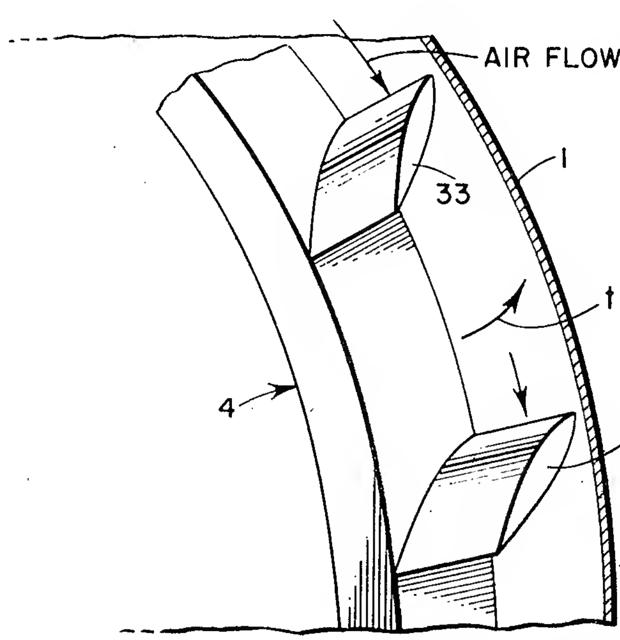


FIG. 7

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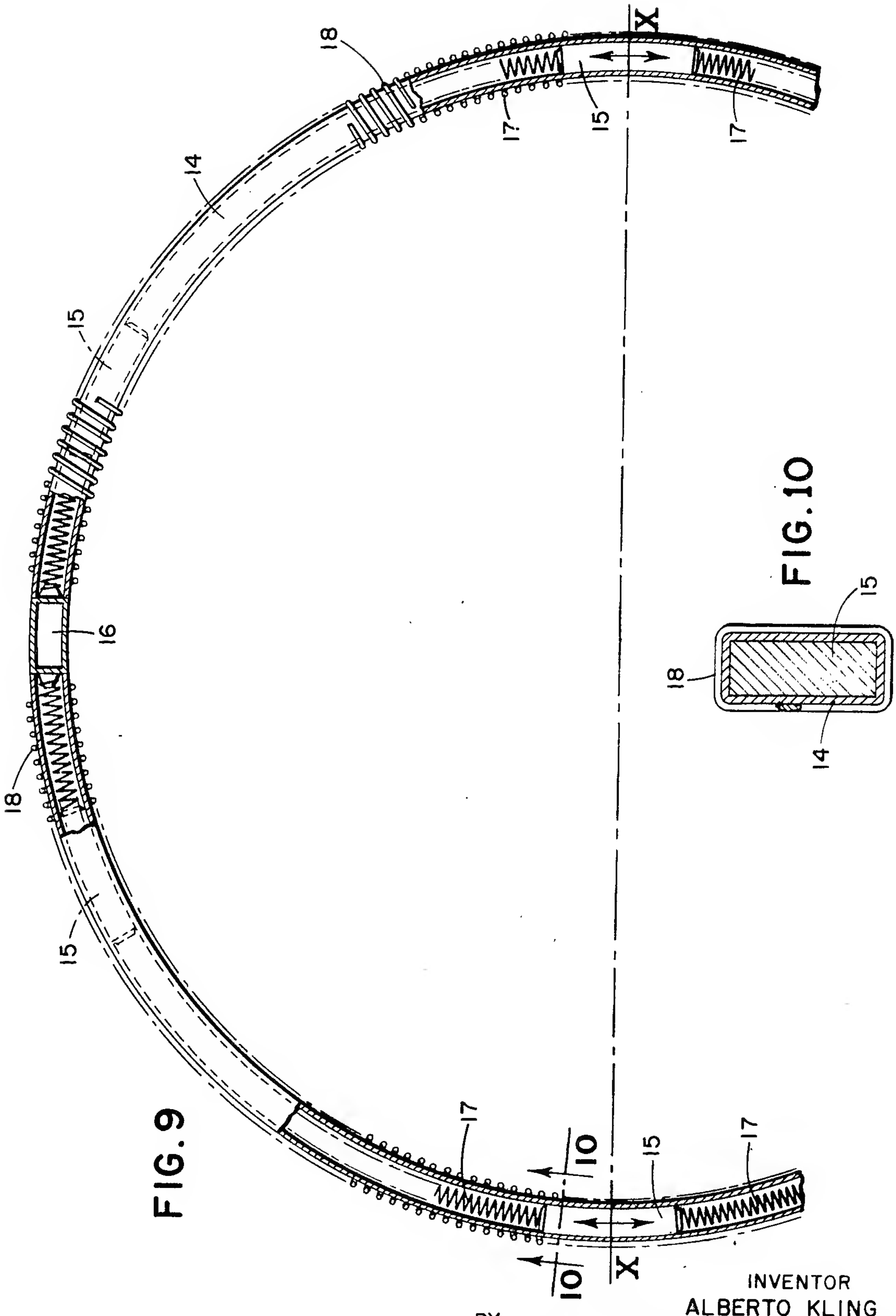

FIG. 9

FIG. 10

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FIG. 11

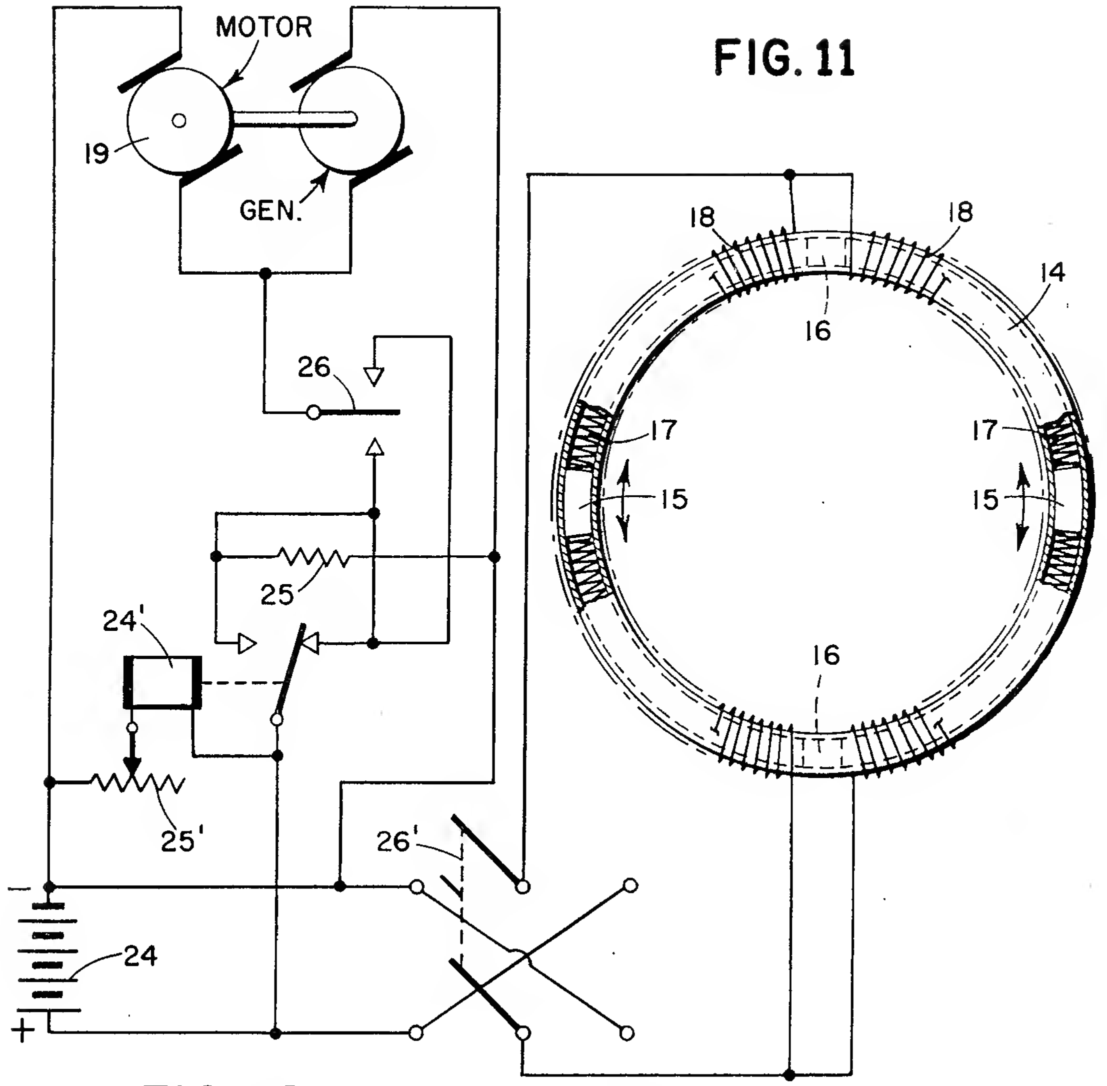


FIG. 12a

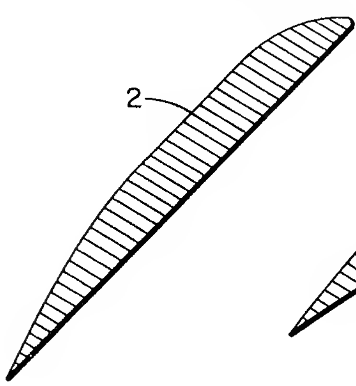


FIG. 12b

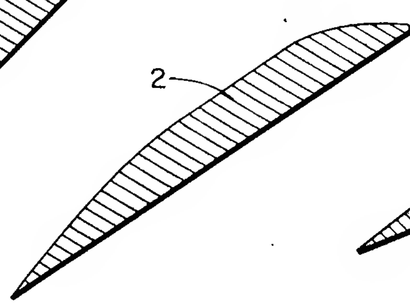
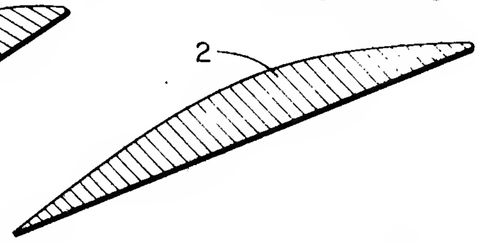


FIG. 12c



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FLYING CRAFT

This invention relates to an aircraft whose outermost fuselage consists of a rotating body on which are mounted propeller-type fins which consequent to said rotation provide lift and propulsive force for the craft while interiorly of said body there is mounted a cabin which is orientable independently of the rotation of said body.

Specifically, the cabin is supported upon the interior of said body by a gimbal arrangement comprising a series of three pivot means whose axes are successively perpendicular to each other so that, excepting for frictional forces, the cabin will not be affected by the rotation of said body or by tilting of said body's rotational axis. In order to realize this condition it is necessary to arrange the rotational drive means of the outer body so that the imparting of driving force thereto is accomplished without any corresponding counterforces or reactions being exerted upon said cabin or any part of the gimbal arrangement.

The rotating body of this invention develops thrust in the direction in which the rotational axis thereof extends and the direction of flight, therefor, can be varied by changing the inclination of said rotational axis. Since, the outer rotating body constitutes a gyroscopic rotational member, the present invention employs the principles of gyroscopic precession for the purpose of changing said inclination of the rotational axis.

In order to conserve fuel it is desired that the craft of this invention have a minimum drag coefficient and in this regard it is preferable, that in planes perpendicular to its rotational axis, the form of the rotating body is a surface of revolution. This includes, interalia, a sphere, an ovoid, an elliptoid, a cylinder, a disc, etc.

The concept of a rotating aircraft is not new. In addition to the popular concept of spinning flying saucers, much serious research has been dedicated in attempts to develop such craft; however, such efforts have failed to materialize into an actual reduction to practice of a practical, operable craft. One of the principle obstacles in this regard, has been an inability to resolve the problem of how to provide a stationary structure, for passengers, etc., within a rotating outer body. The resolution to this problem of how to provide a stationary structure, for passengers, etc., within a rotating outer body. The resolution to this problem appears for the first time in this invention and can be analyzed as residing in the completely new concept of constructing a known gyroscope in reverse fashion. That is, instead of pivotally supporting a rotating body upon an external stationary structure, support a stationary structure pivotally within a rotating outer body.

The craft of this invention is so simple and economical to construct, operate, and to maintain that it is within reason to prognosticate that it will revolutionize air and land travel as it is known today. Specifically, the craft can be constructed from readily available parts and devices which are of standard commercial design and, in any event, the craft requires no expensive or highly complex parts. No transmission gears are required and, as is well known, gear transmission systems are extremely costly and often times the first parts to require replacement. In helicopters, for example, it is a usual requirement that the gears thereof be completely replaced after from 1,000 to 2,000 hours of operating life. Substantially the only wearing parts in the craft of this invention are bearings, an electric motor, and a drive engine which requires no transmission means.

Such a craft, therefore, could be purchased more easily than an automobile and, in fact, automobile manufacturers could easily convert to the construction of this type of craft since the craft does not embody any highly complex aerodynamic principles requiring a high level of aeronautical expertise.

Of extremely great significance, however, is the fact that the draft of this invention is ideally suited for vertical takeoff and landing and, in fact, the craft can hover at any altitude.

In conclusion, the craft of this invention represents the very first realization of an aircraft which may be mass produced and sold at a cost within the means of those who can afford an automobile.

It is an object of this invention to provide a flying craft which comprises a rotating thrust-producing body supporting a stationary cabin.

It is a further object of this invention to provide a flying craft which is ideally suited for vertical takeoff and landing.

It is a further object of this invention to provide a flying craft whose power and fuel requirements are very much lower relative to known aircraft of corresponding load, speed, and range capacity.

It is a further object of this invention to provide in a rotating-type aircraft, a simple means for achieving highly effective and reliable directional control thereof.

It is a further object of this invention to provide a rotating flying craft which is highly stable.

It is a further object of this invention to provide a rotating flying craft which includes a highly stable occupant cabin which, furthermore, is itself easily positionable in accordance with changes in the direction in which the rotating craft is propelled.

Another object of this invention is the provision of a novel aircraft as aforementioned and which is so simple and economical to construct and to operate that it can be sold for no more than a common automobile.

Other objects are those which are inherent in the herein presented disclosure.

The foregoing objects are generally realized through an arrangement comprising a stationary innermost cabin gimballed through three successive mutually perpendicular pivot axes to an outermost rotating hollow shell, and further comprising a drive means for rotating said shell, which drive means acts directly upon the shell without exerting any counter torque upon any other member.

Stated otherwise, the objects of the invention are realized through an arrangement employing the gyroscope principle in a reverse manner, namely: by having the rotating body internally, rather than externally, gimballed on its supporting structure. The craft of this invention, therefore, constitutes a gyroscope whose rotating member is a hollow shell within which is located the stationary support structure therefor.

Details of a preferred embodiment of realization of the invention will now follow with reference to the accompanying drawings, wherein:

FIG. 1 is a pictorial view of the craft of this invention in the position of horizontal flight;

FIG. 2 is a partially sectioned pictorial view of the craft of this invention as it appears in a hovering or in a vertical takeoff and landing position;

FIG. 3 is a vertical sectional view of the craft of FIGS. 1 and 2;

FIG. 4 is a sectional view of a bearing-pivot means employed in the craft of this invention;

FIG. 5 is an enlarged vertical view of the cabin trimming means employed in the craft of this invention;

FIG. 6 is an enlarged vertical sectional view of a landing gear arrangement for the craft of this invention;

FIG. 7 is an enlarged detail view of one embodiment of cabin-trimming means for the craft of this invention;

FIG. 8 is a schematic vertical view of a craft according to this invention but having a second embodiment of propulsive means relative to the craft shown in FIGS. 1 and 2;

FIG. 9 is a partial plan view of a directional control means for the craft of this invention;

FIG. 10 is an enlarged sectional view taken along line 10—10 in FIG. 9;

FIG. 11 is a diagrammatic illustration of the electrical circuitry for a cabin-trimming means and for a directional control means incorporated in a craft of this invention; and,

FIGS. 12*a* to 12*c* are sectional views taken along section lines 12*a*—12*a*, 12*b*—12*b*, and 12*c*—12*c* respectively in FIG. 3.

According to the herein illustrated embodiment, the craft according to this invention comprises an outermost rotatable spherical shell 1 having a plurality of fins 2 extending radially therefrom along respective radii all of which are coplanar, said

fins having a pitch which decreases from the surface of the sphere towards the tip of the fins as is shown in FIGS. **12a** to **12c**. The fins **2** need not all be in one plane. Equal numbers of fins could be arranged in different parallel planes. Further, the plane of the fins need not be a diametral one as is illustrated. Instead, the single plane of fins which is illustrated could be located closer to the base or closer to the top of the craft rather than as shown in FIGS. **2** and **3** wherein the plane of the fins **2** passes through the geometric center of the craft.

Further, although a perfect sphere is actually illustrated, the shell **1** may be ovoid or any other figure of revolution. For example, the shell **1** may be in the form of a flattened sphere, an ovoid, an elliptoid, a disc etc.

The shell **1** is rotatably mounted to a first inner ring **4** by means of axially aligned, opposite pivot means **3** and this first inner ring is in turn rotatably mounted relative to a second inner ring **6** by means of opposed pivot means **5** which are aligned along an axis which is perpendicular to the pivot axis of pivot means **3**. This second inner ring **6** is in turn rotatably mounted relative to an innermost spherical cabin **8** by means of opposed pivot means **7** which are aligned along an axis which is perpendicular to the pivot axis of pivot means **5**.

The fins **2** are attached to shell **1** so that said shell and fins rotate together. Said fins are designed to provide during their rotation lift as well as propulsive force for the craft and in this regard they may be designed to possess any suitable aerodynamic shape as illustrated in FIGS. **12a** to **12c** or they may even simply be flat but inclined at the proper angle of attack. Further, the fins may be of fixed or variable pitch and they may be freely hinged to the shell **1**. In this last instance, the fins will be swung out into the position shown in FIGS. **1** and **2** by the centrifugal force of rotation but when the craft is stationary, the fins will pivot downwardly by virtue of their own weight to the dash line position shown in FIG. **2**.

The fins may either provide the total lift and propulsive force of the craft or said force may be supplemented by suitably directing the jet exhausts from the various jet reaction-type engines which may be utilized in order to rotatably drive the shell **1**.

If the weight of the engines **9** mounted on the fins in FIG. **2** does not make it feasible for said fins to be hinged as shown, various obvious resolutions may be employed. For example, those fins having the engines **9** mounted thereon may be rigidly mounted to shell **1** while all other fins may be hinged as shown. Alternatively, the engines **9** could be mounted on the shell independently of any of the fins, either in the same plane as the fins or in a different plane.

A boundary ring **2'** attached to and circumscribing the fin tips may be employed in order to provide an outermost boundary for the fins and also for preventing entanglement of the fins with other craft, trees, etc. Of significant importance, however, is the fact that such a fin tip boundary member will enhance the lift coefficient of the fins. Said ring **2'** may be of rigid material, or of flexible material especially in the case of hinged fins.

In summary, therefore, the cabin **8** is rotatably mounted relative to and on the shell **1** by means of three successive pivot means **7**, **5**, and **3**, which are successively perpendicular to each other.

The cabin **8** is intended to house the craft's pilot, its fuel, and any payload such as passengers or cargo which the craft may be intended to carry. Further, the cabin **8**, by virtue of the aforedescribed pivotal arrangement, will remain stably in a particular orientation relative to Earth regardless of changes in the orientation of the shell **1** relative to Earth.

The cabin **8** need not be spherical or even of any other analogous rounded shape. It could, for example, be in the form of a cube. Correspondingly, the rings **4** and **6** need not be circular but may be square or any other convenient shape.

The shell **1** can be rotated about pivot means **3** by various means only two of which are illustrated respectively in FIGS. **1–3** and **8**. FIGS. **1–3** show diametrically opposed jet engine means **9** mounted at the tips of fins **2** so that the jet reaction or exhaust from said jet engines will drive the shell **1** clockwise in FIGS. **1–3**. On the other hand, FIG. **8** shows a single rotational driving means comprising a gas turbine **10** which is mounted externally on shell **1** with the axis of rotor **11** being coaxial with the axis of rotation of the shell. The exhaust from said turbine is led through space **12** which is formed between the shell **1** and the double skin **1'** which extends along the upper hemisphere of shell **1**, to diametrically opposed exhaust nozzles **13** whose exhausts are directed whereby the turbine exhaust reaction spins the shell **1** clockwise relative to the orientation of parts illustrated in FIG. **8**.

The double skin **1'** is provided in order that the outermost surfaces of the shell may constitute surfaces of revolution as mentioned previously.

The jet engines **9** of FIGS. **1–3** and the nozzles **13** of FIG. **8** may be positioned at any of various radial distances from the outer surface of shell **1**. For example, the engines **9** could be positioned at some intermediate point along the radial extent of fins **2** or even against the surface of shell **1** and likewise, the nozzles **13** could be radially shortened to exhaust at respective radial points further inwardly than as shown in FIG. **8**. Also, the nozzle exhausts **13** need not be positioned in the same plane as that of the fins **2** but they may be positioned in some other plane or planes. Any number of nozzles **13** or of engines **9** may be employed and in fact they could be used in combination with each other. In FIG. **8** the jet exhausts could be directed downwardly along the angle of attack of the fin tips whereby said exhausts would per se also provide some lift to the craft.

The rotor and wheel **11** of gas turbine **10** are arranged to rotate in an opposite sense relative to the sense in which the shell **1** is driven by the turbine exhausts **13** whereby the moment of momentum of one counterbalances the other to some extent. In fact, the weight and rotational velocity of turbine rotor and wheel **11** are designed so as to counterbalance the moment of momentum of the shell **1** to such an extent as to render the craft easily maneuverable.

It should be especially noted that the rotative drive means for the shell **1** and its attached fins **2** is itself supported entirely on and by the shell itself so that absolutely no torque develops between said shell **1** and any of its rotative supporting structures **4**, **6**, **8** as a result of said shell being driven. The point is that there should be no counteraction as between the shell **1** and the supporting structure **4**, **6**, **8** insofar as the shell's rotative driving force is concerned. Therefore, the rotative drive means must be supported entirely by the shell **1**.

Since the shell **1** and its related fins **2** constitute a rotating gyroscopic body, the principles of precession are employed in order to directionally control said shell **1**.

Primarily, the craft will rest on the ground with its rotational axis being vertical, as shown in FIG. **2**. In order to lift the craft into the air, the shell **1** will be rotated by drive means such as illustrated in FIGS. **1–3** and **8**. This will lift the craft straight up without changing the vertical disposition of its rotational axis and the craft can either continue to so rise or it can hover at any desired altitude. The lifting control is attained through control of the shell's rotational velocity and/or the use of fins **2** which may be of variable pitch. In any event, the craft will maintain a stable orientation with its axis remaining vertical unless a rotational torque is applied to the shell in a plane perpendicular to its plane of rotation whereby the shell **1** will precess according to gyroscopic principles to an inclined position as shown in FIG. **1**, and in this position the craft will fly in the direction indicated by the horizontal arrow. As is seen in FIG. **1**, the plane of the fins **2** is inclined downwardly in the direction of flight. The particular direction of flight at a given rotational speed of the shell will depend upon the tilt angle of the rotational axis T—T relative to the horizontal.

FIG. **9** illustrates a type of directional control means which can be used to bring about the aforementioned precession of the shell **1** into any desired direction.

The circular tube **14**, which may be of any cross-sectional shape, is rigidly attached to ring **4** in a plane which may be

perpendicular to that of said ring 4, as shown in FIG. 2; however, tube 14 need not be in a plane perpendicular to the plane of ring 4 but may be in any plane. In fact, ring 4 itself may serve the functions of said tube 14 so that said tube and said ring may coincide. A pair of equal weights 15 are mounted within said tube normally at a neutral position corresponding to said weights being at diametrically opposite points relative to each other along axis X—X, said weights being slidable along the tube length towards each other in either rotative sense from said axis X—X. A stop 16 is fixedly positioned at each of two diametrically opposite points within said tube along a diameter perpendicular to the neutral position of the weights as shown in FIG. 9. Spring means 17 extend between each end of the weights and the stops, said spring means urging the weights into said neutral position and so long as the weights actually do remain in this position the shell 1 will remain in whatever tilt position in which it may be at the moment. On the other hand, if the weights are brought closer together from the neutral position thereof of FIG. 9, as for example to the dotted line position shown in FIG. 9, they exert a rotative torque upon the ring 4 about the neutral axis X—X which is perpendicular to the axis of pivot means 3. This rotative torque is in turn transmitted to the shell 1 through said pivot means 3 and since the shell is a rotating body, it will tilt in accordance with the principles of gyroscopic precession thereby altering its previously held orientation. The degree of tilting will depend upon the extent or closeness to which said weights are permitted to approach each other and the length of time that they are maintained at that position.

In the instance in which tube 14 is perpendicular to ring 4, the neutral axis X—X is perpendicular to the axis of pivot means 3—3. On the other hand, when the ring 4 which is shown in FIG. 2 itself coincides with said tube 14, the axis X—X coincides with the axis of the pivot means 3—3 which in turn coincides with the rotational axis T—T of the shell 1.

The positioning of the weights is controlled by solenoid winding means 18 wound about the tube, the weights therefore being of magnetic material in order to serve as the solenoid movable core. The energization of the winding means in turn can be easily controlled by the pilot in the cabin 8.

The weight means of FIG. 9 is only exemplary. Other torque-applying means may be employed instead.

It has already been mentioned relative to FIG. 8 that the weight and rotational velocity and direction of rotation of gas turbine rotor 11 are selected so as to counterbalance the moment of momentum of the shell 1. Such counterbalancing makes it possible to reduce the mass of the weights 15 relative to the weights which would be necessary in a craft not incorporating said counterbalancing feature.

The cabin 8 will be subjected to various frictional forces tending to make it follow the rotation of the shell 1. For obvious reasons it is desired to maintain the cabin stationary. On the other hand, it is necessary to turn the cabin, whenever the craft changes direction, in order to have it face in the direction of flight. FIG. 5 illustrates a cabin control means according to the invention.

A motor-generator unit 19 is coaxially mounted with the craft's rotational axis and has its stator 20 rigidly secured to the shell 1 with said stator extending outwardly from said shell and being bolted directly to a plate 22 which in turn is suitably secured along the outer surface of shell 1. The motor-generator rotor 23, on the other hand, is rigidly bolted to first inner ring 4 so that during normal operation the stator 20 spins around with the shell around the rotor 23. Element 23' constitutes a bearing support for the rotor shaft said support being rigidly attached to the shell structure.

Electric current flows between the motor-generator unit and either a storage battery 24 (FIG. 11) or any one of the various well-known current consumers or dissipators such as a resistance 25, through a switch means 26 located in the cabin 8. Further, any known slip ring means may be adapted for the purpose of maintaining continuous electrical connection between the rotating stator and the stationary rotor of the motor-generator unit. A possible such means is illustrated in FIG. 5 and includes an annular support 27 attached rigidly to the inner side of shell 1 coaxially with the motor-generator unit and another such support 28 attached rigidly to the outer side of ring 4. A pair of annular slip ring means 29 are mounted on the rotating support 27 while corresponding brush means 60 are mounted on stationary support 28. The respective slip rings and their associated brushes are of course insulated from each other.

The motor-generator unit will normally act as a motor-taking current from the battery to accelerate the rotor 23 in a direction opposite to that in which said rotor is urged by the frictional forces acting upon the internal structure. In this instance the rotor is accelerated just sufficiently to counteract such frictional forces which are in any event relatively very small.

At times during which it is desired to turn the cabin 8 in conformity with a change in flight direction, the pilot simply actuates the switch means 26 to feed additional current from the batter to the motor-generator unit so that the rotor 23 is made to rotate opposite to the direction of rotation of the shell thereby turning with it the ring 4 and through this also the cabin. If the pilot wishes, however, to bring the cabin to its new position by rotating it in the same direction as the rotational direction of the shell, he simply actuates a switch 26 in the cabin whereby the motor-generator unit is made to act as a generator-feeding current to a consumer such as the resistance 25 or battery 24. This generator action results in a braking force being imposed upon the rotor so that the rotor in turn brakes the inner structure 4, 6, 8 to such an extent that the cabin will rotate in the same direction as the shell. It is to be noted, however, that since the motor-generator is coaxial with the shell's rotative axis, this turning of the cabin is realized without there being exerted any countertorque upon the shell which would tend to make it precess into another tilt position.

The relay 24' shown in FIG. 11 serves to automatically switch the generator action of motor-generator 19 from the battery 24 to the resistance 25 and vice versa depending upon the extent to which the battery is charged, thereby protecting said battery from an overcharge while also providing charging current therefor when it is undercharged. The rheostat 25' sets the voltage at which the relay switches the battery off the line.

The battery 24 may also be connected through the switch 26', which is also located in the cabin, with the solenoid means 18 (FIG. 9) which acts upon weight 15 against the action of spring means 17, as previously described.

Reverting to FIGS. 2, 3, and 6 a cabin control or trimming means auxiliary to that of FIG. 5 is shown incorporated into the landing gear 30 which is in the form of an inverted cup-shaped bonnet which could be of rubber, the peripheral edge portion of which includes aerodynamic vanes 31, either attached or integrally formed in the bonnet body, and whose angle of attack is opposite to that of the fins 2. The bonnet 30 is rotatably mounted relative to shell 1 coaxially with pivot means 3 but rigidly attached to first inner ring 4. The downward airflow created by the rotation of fins 2 induces a torque on vanes 31 tending to turn the bonnet 30 and through it the ring 4 about the axis of pivot means 3 and in a sense opposite to the rotational sense of shell 1. This torque counteracts the tendency of cabin 8 to follow the rotation of the shell so that the cabin remains stationary. In fact, the bonnet vanes may be designed so that they induce a torque greater than and opposite to the torque induced in the internal structure by the frictional forces existing between said structure and the outer shell 1. This greater torque is utilized to urge the rotor of the motor-generator set oppositely to the direction of rotation of the shell 1 and the motor-generator set thereby functions as a generator generating a small current which is utilized to charge the battery. It should be understood, however, that said rotor does not actually rotate in this last-mentioned situation since the generating action concomitantly serves to brake the rotor.

A further auxiliary cabin control means is also illustrated in FIGS. 3 and 7 in the form of holes 32 in the top and bottom of shell 1, those at the bottom being arranged along a circle of larger diameter than those at the top, and both sets of holes being concentric with the shell's rotational axis. Because of this difference in the positions of the upper and lower holes, an air-pumping action occurs during rotation of the shell causing an airflow from the atmosphere into the upper holes, downwardly along the inner surface of the shell, and outwardly of the lower holes. Suitable fins 33 are rigidly mounted on first inner ring 4 in the airflow path so that a torque t is impressed upon said fins and the ring 4 analogous to the torque produced by vanes 31.

FIG. 6 illustrates constructional details of a manner in which the landing gear of FIG. 2 may be mounted to the craft.

The bonnet 30 will be secured to the landing gear plate 34 which through a combination of ball and roller bearings 35 and 36, respectively, is rotatably mounted relative to shell 1, although it should be recalled that it is the shell which rotates while the landing gear is substantially always stationary. The ball bearings are of course excellent as to withstanding axially directed stresses while the roller bearings are preferably included to withstand radial stresses which may occur if the craft is landed with some horizontal thrust. Shock absorbing spring means 37 are provided in conjunction with the ball bearings while spring means 38 serve as resilient suspension means between a rigid L-shaped annular rim 40 of the shell 1 and the landing gear hub 41 on which are mounted the roller bearings. The roller bearings 36 are axially movable relative to rim 40 together with said hub 41.

Said hub 41 has a central axially extending bore 42 into which extends a rod 43, the hub and rod being secured together against relative rotation by a key and groove arrangement 44 in which the groove is longer than the key whereby the hub may slide axially relative to the rod. Said rod extends upwardly through a central axial bore in a cylindrical member 45 which is rigidly attached to the shell 1 and extends radially inward thereof towards the first inner ring 4, the rod 43 in turn being rigidly bolted to said ring 4. Said cylindrical member 45 is rotatably supported on its outer surface relative to a stationary bearing support 46 which is rigid with ring 4 by means of roller bearings 47. An annular channel 48 is formed between bearing support 46 and an axial extent of said cylindrical member 45. Said channel includes oil sealing means at opposite axial ends thereof. A passageway 49 connects the channel to a fuel line coming from the craft's fuel tanks which may be located within cabin 8 or along one of the rings 4 or 6. A bore 50 within member 45 communicates at its top end with said channel 48 and at another point with a fuel line 49′ leading to the rotative drive means located externally of the shell 1.

Fuel connection means such as cylindrical member 45 and the channel 48 or similar means are of course utilized at any other point at which a fuel connection must be made between two parts which are rotatable relative to each other. This likewise applies to the slipring means of FIG. 5 relative to electrical connections between relatively rotatable parts.

Relative to the FIG. 3 embodiment, it is feasible to locate fuel tanks along the inner side of shell 1 connected directly by fuel lines to the drive means 9 in which case the fuel would require, during rotation of the shell 1, only the centrifugal force of said rotation to be fed to the drive means.

Various (not illustrated) refinements are within the scope of the invention. For example, a differential pressure effect sometimes called a "baseball effect" would occur when the craft is flying in any direction transverse to its rotational axis. That is, because of its spin the air velocity past one side of the shell will be greater than that along the opposite side and the craft would tend to follow a curved path, analogously to a pitched baseball, rather than a rectilinear path. Since this curving tendency is proportional to the forward velocity, it can be compensated for by means of a pitot tube extending outwardly of the shell and facing in the direction of flight, this tube in turn being arranged so that the dynamic air pressure therein is utilized as a sensing means to provide the required degree of precession necessary to compensate for said baseball effect. For example, the pressure sensed by the pitot tube could be translated into a displacement of the weights 15 (FIG. 9) to a position just sufficiently distant from their neutral position to compensate for the aforementioned curving effect.

The shell 1 and the cabin 8 can both be made of transparent plastic material so as to provide visibility for the occupants of the cabin. Alternatively, the shell may include a circumferentially extending window means 51 suitably aligned with a window 52 on said cabin whereby continuous visibility would be provided into the cabin.

FIG. 4 illustrates a practical embodiment of the manner in which two successive relatively rotatable parts are assembled in the craft of this invention. Primarily, it is to be noted that, in order to achieve structural rigidity, the shell 1 and the cabin 8 may each be comprised of a plural number of channel-shaped rings r (see FIG. 3) which are rigidly interconnected and which provide respective rigid frameworks for relatively lightweight skins s which form the outerwall of the shell and of the cabin, respectively, said skins being of course attached to said frameworks. In turn, each ring 4 and 6 may itself be in the form of such a channel-shaped member r as is in fact illustrated in FIGS. 4 and 6 with reference to ring 4 and as is illustrated in FIG. 3 with reference to ring 6 as well. For purposes of simplicity, each ring 4 and 6 has been illustrated as comprising a single such channel-shaped member r upon which are mounted the respective pivot means 3—3, 5—5 and 7—7; however, additional similar channel-shaped members of circular form may be rigidly crisscrossed with the shown rings 4 and 6 to reinforce same.

FIG. 4 exemplifies a pivot means for rotatably connecting ring 6 to the reinforcing channel r of ring 4 which in turn is rigidly connected with a crisscrossing similar channel r'. As is seen in this figure, a pivot pin 53 is rigidly connected with one ring (that of ring 4) and extends through a hole in the other ring (ring 6) while ball and roller bearings 54 and 55 permit rotation of the ring 4 relative to ring 4 about axis P—P.

Various constructional details which may have been omitted are not essential to an understanding of the inventive concepts disclosed herein. For example, it is obvious that some access means through the shell and into the cabin must be provided but the provision of same is well within the purview of one skilled in the art.

It is of course understood that the outwardly protruding casing of the cabin trimming means shown in FIG. 5 as well as the casing of the rotative drive means of FIG. 8 are in the form of surfaces of revolution relative to the rotational axis T—T.

Various details presented herein relative to practical embodiments of the invention are for illustrative purposes and are not limitative of the modes of realization of the disclosed inventive concepts, such details being susceptible to various modifications, substitutions, etc. without departing from the scope or spirit of said inventive concepts.

What is claimed is:

1. A flying craft comprising an outer shell internally of which there is mounted a support structure, and including a drive means for rotating the shell independently of the support structure, characterized in that:

a. said support structure is positioned within the boundaries of said shell;

b. said structure is mounted to said shell by a means constituting a Foucault-type cardanic suspension system including successive pivot means whose axes are successively perpendicular to each other;

c. control means are provided to impart a torque to said shell whereby the axis of rotation thereof will reorient itself in accordance with the principles of gyroscopic precession; and

d. said shell including external fins thereon for aerodynamically producing a propulsive thrust along the direction of the shell's rotational axis.

2. The craft of claim 1, said shell having the shape of a surface of revolution about the rotational axis thereof.

3. A flying craft as in claim 1, said shell having means mounted thereon for integral rotation therewith for aerodynamically producing a propulsive force as a result of such rotation.

4. The craft of claim 1, said control means comprising a directional control means adapted to exert a rotational torque upon said shell in a plane perpendicular to the plane in which said shell rotates at any particular time, whereby the rotational axis of said shell will tilt to another position in accordance with the principles of gyroscopic precession.

5. The craft of claim 1, said drive means comprising a jet exhaust means mounted on said shell and arranged to exhaust in a direction whereby rotative force is imparted to said shell by such exhaust.

6. The craft of claim 3, said propulsive force being directed parallel to the rotational axis of said shell.

7. The craft of claim 3, said means for producing a propulsive force comprising a plurality of thrust-producing fins on said shell.

8. The craft of claim 4, wherein said directional control means includes a weight means displaceable from a neutral position thereof in either of two opposite directions away therefrom in a plane perpendicular to the rotational axis of said shell.

9. The craft of claim 5, said drive means comprising a jet engine means mounted on said shell radially of the rotational axis thereof.

10. The craft of claim 5, said drive means comprising a jet engine means mounted on said shell along the rotational axis thereof and including conduit means extending the exhaust of said jet engine means to respective locations radially displaced from said rotational axis.

11. The craft of claim 7, said fins being hingedly attached to said shell whereby they are centrifugally thrown to a radially extended position relative to the shell's rotational axis pursuant to rotation of said shell.

12. The craft of claim 7, a plurality of said fins extending radially outwardly from said shell along respective radii which are in a common plane, a boundary ring circumscribing the tips of said fins whose radii are in a common plane.

13. The craft of claim 8, wherein said weight means constitutes the movable core of an electric solenoid means.

14. The craft of claim 11, said fins being free to pivot in either direction from said radially extended position.

15. The craft of claim 12, said boundary ring being of flexible material and said fins being hingedly attached to said shell whereby they may pivot about respective axes which are transverse to the shell's rotational axis.

6. A flying craft comprising an outer shell internally of which there is cardanically supported a cabin by means of a support structure, and including a drive means for rotating the shell independently of the cabin, characterized in that:

a. said support structure and cabin are positioned within the boundaries of said shell;

b. said support structure for said cabin constitutes a Foucault-type cardanic suspension system including three successive pivot means whose axes are successively perpendicular to each other;

c. control means are provided to impart a torque to said shell whereby the axis of rotation thereof will reorient itself in accordance with the principles of gyroscopic precession;

d. said drive means being arranged to impart a rotative force to said shell independently of any counterforce being exerted by said drive means against any part of said support structure or of said cabin; and

e. said shell including external fins thereon for aerodynamically producing a propulsive thrust along the direction of the shell's rotational axis.

17. The craft of claim 16, including a trimming means for determining the orientation of said cabin independently of the rotation of said shell.

18. The craft of claim 16, said support structure comprising a first support member pivotally mounted on said shell internally thereof about a first pivot axis, a second support member pivotally mounted on said first member about a second axis perpendicular to said first axis, and said cabin being pivotally mounted on said second member about a third axis perpendicular to said second axis, said first axis being the rotational axis about which said shell is driven by said drive means.

19. The craft of claim 17, wherein said trimming means comprises a second drive means arranged to exert a rotational torque upon said support structure relative to said shell about the axis or rotation of the latter.

20. The craft of claim 18, said shell being in the form of a surface of revolution about said first axis and including external fins thereon for aerodynamically producing a propulsive thrust along the direction of said first axis pursuant to rotation of said shell.

21. The craft of claim 18, said control means comprising a directional control means arranged to exert a rotational torque upon said first support member in a plane perpendicular to said first axis whereby said first axis will tilt in accordance with the principles of gyroscopic precession if such a torque is applied during the rotation of said shell.

22. The craft of claim 18, including a trimming means for determining the orientation of said cabin independently of the rotation of said shell, said trimming means comprising a second drive means arranged to exert a rotative torque on said first member about said first axis.

23. The craft of claim 19, said second drive means comprising a stator and a rotor portion, respectively, coaxially mounted with the rotational axis of said shell, one of said portions being rigidly connected with said shell and the other of said portions being rigidly connected with said support structure, said stator and rotor portions being adapted to transmit torque between each other.

24. The craft of claim 21, wherein said directional control means comprises a weight means displaceably mounted on said first member between a balanced and an unbalanced condition relative to said first axis.

25. The craft of claim 22, said second drive means comprising a stator and a rotor portion, respectively, which are rotative relative to each other along said first axis and of which one is rigidly connected with said shell and another is rigidly connected with said first member.

26. The craft of claim 22, said second drive means being a motor-generator set and including a source of electrical energy and an electrical energy dissipator selectively connectable to said set whereby said set may function either as a motor of as a generator.

27. The craft of claim 22, said second drive means including interreacting drive portions respectively secured to said shell and to said first member.

28. The craft of claim 22, further including a landing gear arranged to extend outwardly of said shell, said gear being rotatively rigidly secured to said first member and being rotatable relative to said shell.

29. The craft of claim 23, said second drive means being a motor-generator set, and including a source of electrical energy and an electrical energy dissipator selectively connectable to said motor-generator set in order to operate said set either as a motor or as a generator, respectively.

30. The craft of claim 23, including an auxiliary trimming means comprising aerodynamically driven means arranged to rotatively urge said support structure oppositely to the rotational sense of said shell.

31. The craft of claim 24, said balanced condition corresponding to said weight means being positioned along said first axis and said unbalanced condition corresponding to said weight means being radially displaced from said first axis.

32. The craft of claim 24, said weight means comprising a pair of weights mounted on said first member for displacement in a plane perpendicular to said first axis, said balanced condition corresponding to said weights being diametrically opposite to each other along a neutral axis which is perpendicu-

lar to said first axis, and said unbalanced condition corresponding to said weights being less than 180° apart from each other on either side of said neutral axis.

33. The craft of claim **24**, said weight means constituting the movable core of an electric solenoid means.

34. The craft of claim **25**, said shell including means to produce airflow pursuant to rotation thereof, said craft including an aerodynamic means arranged to be acted upon by such airflow and to induce a rotative torque upon said first member about said first axis in a sense opposite to the sense in which said shell rotates.

35. The craft of claim **26**, wherein the rotor of said set is rigidly connected with said first member and the stator of said set is rigidly connected with said shell whereby said stator rotates about said rotor together with said shell.

36. The craft of claim **28**, said gear and said second drive means being arranged along a common axis which is coincident with said first axis.

37. The craft of claim **28**, including external propeller-type fins on said shell for inducing pursuant to rotation of said shell an airflow in a direction parallel to said first axis in order to provide propulsive thrust to said craft, said landing gear being located in the downstream side of said fins and including means responsive to such airflow for inducing a torque on said gear counter to the rotational sense of said shell.

38. The craft of claim **29**, including an electric switch means actuable from within said cabin for effecting such selective connectability.

39. The craft of claim **29**, the stator of said set being rigidly connected to said shell and being integrally rotatable therewith, the rotor of said set being rigidly connected to said support structure.

40. The craft of claim **30**, said auxiliary trimming means comprising vanes mounted externally of said shell but rigidly attached to said support structure, said vanes being coaxially arranged relative to the rotational axis of said shell, said shell having thrust means mounted thereon for integral rotation therewith and arranged to induce an airflow towards said vanes pursuant to rotation of said shell, said vanes being urged by said airflow to rotate oppositely to the rotative sense of said shell.

41. The craft of claim **30**, said auxiliary trimming means comprising two spaced-apart groups of holes in said shell arranged around the shell's rotational axis, the holes of one of said groups being disposed along an outline of wider radius than those of the other of said groups whereby an airflow is induced by the rotation of said shell from atmosphere and through the holes of said other group into said shell and outwardly thereof through the holes of said one group, and further including vanes on said support structure and in the path of said airflow, said vanes being arranged to urge said structure rotatively oppositely to the rotational sense of said shell.

42. The craft of claim **39**, said motor-generator set being designed to act as a motor and to correspondingly exert upon said rotor a rotational torque opposite and just equal to the rotational torque impressed upon said support structure by the rotating shell as a result of friction existing between said shell and said structure.

43. The craft of claim **39**, said motor-generator set being designed to act as a motor and to correspondingly accelerate said rotor in a rotative sense opposite to the rotational sense of said shell.

44. The craft of claim **40**, including a landing gear mounted externally of said shell, and coaxially with the rotational axis thereof, said gear being rotatively independent of said shell but rotatively rigidly connected with said support structure, said vanes being part of said landing gear.

45. The craft of claim **43**, said motor-generator set being designed to also act as a generator and to correspondingly brake said rotor whereby it rotates in the same sense as the rotative sense of said shell.

46. The craft of claim **44**, said landing gear being in the form of an inverted cup-shaped bonnet, said vanes being integrally formed along the outer peripheral edge of said bonnet.

47. The craft of claim **44**, said gear being axially displaceable relative to said shell and to said support structure.

48. The craft of claim **47**, including shock-absorbing means between said gear and said shell and further including a resilient suspension means supporting said gear from said support structure.

49. An aircraft comprising a rotatable body and means for generating a propulsive thrust along the direction of the axis of rotation of the body, the direction of such thrust determining the direction of flight of the craft through the air, said body while rotating constituting the rotor of a Foucault-type gyroscope, and including a directional control means for selectively imparting a torque to said body while rotating whereby its axis of rotation will reorient itself in accordance with the principles of gyroscopic precession, and a drive means for rotating said body without imparting any precessive torque upon same.

50. The aircraft of claim **49**, said drive means comprising an engine supported entirely by and connected solely to said body.

51. The aircraft of claim **49**, including a structure suspended internally of said body by a suspension system whereby said body may rotate independently of said structure, said body and structure in combination constituting a Foucault-type gyroscope.

52. The aircraft of claim **49**, said body including aerodynamic fin means thereon integrally rotatable with said body for producing the aforementioned thrust through aerodynamic reaction with the atmosphere during rotation of said body.

53. The aircraft of claim **51**, said drive means being arranged to impart a rotative torque to said body solely through reaction of said drive means with the atmosphere whereby said drive means exerts no countertorque upon said structure.

54. The aircraft of claim **51**, said suspension system being a cardanic suspension system.

55. The aircraft of claim **54**, including a landing gear extending outwardly of said body and being rotatable relative thereto about the rotational axis thereof, said gear being rotatively rigid relative to said cabin about said rotational axis.

56. The aircraft of claim **54**, said structure including an innermost cabin and said suspension system comprising a series of three pivot means extending from said body to said cabin the respective axes of which are in perpendicular succession to each other.

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